We claim

1. A detector for thermal neutrons, said detector comprising

at least a pBN layer having a thickness of between 1-1000 microns between the opposed edge surfaces;

at least one metalized contact on each of said opposed surfaces to detect the presence of neutrons striking one of the two opposed surfaces;

wherein said pBN layer is doped with an elemental dopant selected from the group of carbon, silicon, titanium, aluminum, gallium, germanium, or combinations thereof, for an electrical resistivity of less than about 10^{14} ohm-cm.

2. The neutron detector of claim 1, wherein said pBN layer is doped with oxygen as a second dopant.

3. The neutron detector of claim 1, wherein each opposed surface has a plurality of metalized contacts, wherein the contacts are separated from each other by a distance of between 20 and 100 microns.

4. The neutron detector of claim 1wherein the thickness between the opposed edge surfaces is less than about 100 microns.

5. The neutron detector of claim 1, wherein said at least one contact is in the form selected from one of a metalized strip and a raised dot.

6. The neutron detector of claim 1, wherein said pBN layer is doped with carbon in an amount of less than about 3 wt. %.

7. The neutron detector of claim 1, wherein the pBN in said pBN layer is produced by a vapor phase reaction process with a ^{10}B-enriched boron halide feed for said pBN to comprise at least 12 atomic % boron-10 (^{10}B) isotope.

8. A system for measuring a thermal neutron emission from a neutron source, said system comprising the neutron detector of claim 1.

9. A system for measuring a thermal neutron emission from a neutron source, said system comprising the neutron detector of claim 7.

10. A method of forming a neutron detector to detect the presence of neutrons, said method comprising the steps of

forming at least a layer having an electrical resistivity of less than about 10^{14} ohm-cm and a thickness of between 1-1000 microns between the opposed edge surfaces, said layer comprising pyrolytic boron nitride (pBN) containing boron-10 (^{10}B) isotope and an elemental dopant selected from the group of carbon, silicon, titanium, aluminum, gallium, germanium, or combinations thereof; and

forming electrical contacts on each of said opposite sides of said doped pBN layer.

11. The method of claim 10, wherein forming electrical contacts on each of said opposite sides comprising the steps of carving channels on each of said opposite sides and back-filling said channels with metalized strips.

12. The method of claim 10, wherein forming electrical contacts on each of said opposite sides comprising applying metalized contacts to each of said opposite sides.

13. The method of claim 10, wherein said electrical contacts are in the form of strips separated from each other a distance of between 20 and 100 microns.

14. The method of claim 10, wherein said electrical contacts are formed by a lithography process comprising the steps of

forming a photosensitive resist layer on a surface of the doped pBN material;

passing light through a mask onto the photosensitive resist layer with the mask having a desired pattern to create a cured image of the pattern on the photosensitive resist layer where the light gets through the mask;

removing the cured resist from the resist layer to form channels in the resist material;

applying an etchant in said channels to form corresponding trenches in the doped pBN material below the channels;

evaporating metal material over the resist material and over the trenches; and

chemically removing the evaporated metal material and resist material except in the area of the trenches to form an array of metallized contact strips aligned parallel to each other.

15. The method of claim 10, wherein said electrical contacts are formed by ion implantation in which a dopant is implanted in the surface of the pBN material forming

metal contact strips having a controlled resistivity at the implanted surface of the pBN material.

16. The method of claim 10, wherein said dopant is carbon.

17. The method of claim 10, wherein said pBN comprises at least 12 atomic % ^{10}B.

18. A method for measuring a thermal neutron emission from a neutron source, said method comprises:

a) providing a detector comprising: (i) a layer having an electrical resistivity of less than about 10^{14} ohm-cm and a thickness of between 1-1000 microns between the opposed edge surfaces, said layer comprising pyrolytic boron nitride (pBN) containing boron-10 (^{10}B) isotope and an elemental dopant selected from the group of carbon, silicon, titanium, aluminum, gallium, germanium, or combinations thereof; and (ii) at least one metalized contact on each of said opposed surfaces to detect the presence of neutrons striking one of the two opposed surfaces in a direction essentially perpendicular to the c-axis;

b) exposing said detector to thermal neutrons which cause said detector to emit charges, which are subsequently recorded by an output device.

19. The method of claim 18, wherein said pBN comprises at least 12 atomic % ^{10}B.

20. The method of claim 16, further comprising the step of orienting the detector relative to a source of neutrons for the neutrons to enter the detector and interact with the ^{10}B in said pBN layer for electrons to be released and conduct through said doped pBN layer.